HOSTED BY

ELSEVIER

Contents lists available at ScienceDirect

Journal of Acute Disease

journal homepage: www.jadweb.org

Original article http://dx.doi.org/10.1016/j.joad.2016.08.017

Comparison of ultrasound interventional and laparoscopic surgeries for ovarian cyst pediculotorsion

Zhi-Hui Cai, Wei-Ming Wang*, Jun-Rong Shi, Yi-Juan Liang, You-Ju Ma, Jin-Zhi Zhang

Department of Gynecology, Affiliated Hospital of Hebei University, Baoding 071000, Hebei Province, China

ARTICLE INFO

Article history:
Received 14 Jun 2016
Accepted 3 Aug 2016
Available online 20 Sep 2016

Keywords:
Ultrasound interventional surgery
Laparoscopic surgery
Ovarian cyst pediculotorsion
Wound degree
Ovarian function

ABSTRACT

Objective: To study the wound degree and ovarian function of ultrasound interventional and laparoscopic surgeries for ovarian cyst pediculotorsion.

Methods: Patients with ovarian cyst pediculotorsion admitted to Affiliated Hospital of Hebei University from May 2012 to August 2015 were selected. Patients underwent emergency ultrasound interventional operation were allocated into ultrasound intervention group and patients underwent laparoscopic surgery were allocated into laparoscopic group. The patients' conditions of two groups in perioperative period were compared. Before and after operation, the serum contents of total bilirubin, albumin, creatinine, blood urea nitrogen, tumor necrosis factor-alpha (TNF-α), interleukin-1β (IL-1β) and IL-6 were measured respectively. Serum contents of follicle-stimulating hormone, luteinizing hormone and estradiol were measured at 3 months, 6 months and 12 months after operation.

Results: The operation time of ultrasound intervention group was shorter ($P < 0.05$) and the medical fees of it was lower than laparoscopic group ($P < 0.05$), while the serum contents of total bilirubin, albumin, creatinine and blood urea nitrogen during the perioperative period of two groups had no obvious changes and differences ($P > 0.05$). There was no significant difference in the recurrence rate after operation ($P > 0.05$). There was no significant difference in the serum contents of TNF-α, IL-1β, and IL-6 before and after operation in ultrasound intervention group ($P > 0.05$). While in laparoscopic group, serum contents of TNF-α, IL-1β and IL-6 after operation were significantly higher than those before operation ($P < 0.05$). And the serum contents of TNF-α, IL-1β and IL-6 after operation in ultrasound intervention group were significantly lower than those in laparoscopic group before operation ($P < 0.05$). The serum contents of follicle-stimulating hormone, luteinizing hormone and estradiol between two groups were not significantly different at 3 months, 6 months and 12 months after operation ($P > 0.05$).

Conclusions: Ultrasound interventional surgery has quite the same curative effect as laparoscopic surgery in ovarian cyst pedicle pediculotorsion, which also can reduce the surgical trauma, shorten the operation time and lower the operation cost.

1. Introduction

Ovarian cyst pediculotorsion is one of the serious complications of ovarian cysts and about 10% of it occurs pediculotorsion. Pediculotorsion is more likely to be happened for the cyst with longer tumor pedicle, larger tumor size and stronger movement[1,2]. When ovarian cyst is influenced by the movement, postural changes and other factors, cyst twists with the pedicle as the axis and leads to oppressed blood vessel of tumor pedicle. Then, the blocked vein blood flow will cause tissue edema and blocked artery blood flow will cause tissue ischemia and necrosis, thus leading to the symptoms of abdominal pain, nausea, vomiting and other acute abdomen[3,4]. The key of clinical treatment of ovarian cyst pediculotorsion is to remove the torsion by the emergency surgery. The traditional way is to remove the torsion, get rid of the cyst and clear the inactive ovarian tissue by laparotomy. However, laparotomy is more traumatic which will lead to a great damage to the inactive ovary of diseased side and is not conducive to postoperative recovery[5,6].

*Corresponding author: Wei-Ming Wang, Department of Gynecology, Affiliated Hospital of Hebei University, Baoding 071000, Hebei Province, China.
Tel: +86 15833868558
E-mail: czh20106152@163.com

Foundation Project: Supported by Science and Technology Planning Project of Hebei Province in 2013 through the project "The Expression and Significance of DJ-1 Protein in Ovarian Canner" (Project No. 132777163).

Peer review under responsibility of Hainan Medical College. The journal implements double-blind peer review practiced by specially invited international editorial board members.

Ultrasound interventional and laparoscopic surgeries are the minimally invasive surgical approaches newly developed in recent years which are both used in the emergency treatment of ovarian cyst pediculotorsion and have got positive effects. Laparoscopic surgery can significantly reduce surgical trauma, improve the accuracy of the operation and maximize the protection of ovarian function in the process of removing the cyst and torsion[7]. The cyst is punctured with ultrasound interventional treatment guided by ultrasound and alcohol is injected to close and adhere to it. With the elimination of cyst, pediculotorsion is also relieved and diseased side will not lose its function of normal ovary[8]. At present, there are no more reports about the degree of trauma and ovarian function in ultrasound interventional and laparoscopic surgeries for ovarian cyst pediculotorsion. In the present study, we aimed to analyze the degree of trauma and ovarian function in ultrasound interventional and laparoscopic surgery for ovarian cyst pediculotorsion.

2. Materials and methods

2.1. Case materials

The patients with ovarian cyst pediculotorsion who underwent emergency surgery in our hospital from May 2012 to August 2015 were selected. Inclusion criteria were as follows: (1) lower abdominal pain, a fixed tenderness point identified in physical examination, with or without nausea and vomit; (2) ovarian cyst pediculotorsion was confirmed by B-mode ultrasonography; (3) carrying out ultrasound interventional or laparoscopic surgeries. Exclusion criteria: (1) patients having medical history of ovarian cyst rupture and pediculotorsion; (2) patients having laparotomy or transferring laparotomy; (3) patients with ovarian malignant tumor. A total of 79 patients, including 42 patients with laparoscopic treatment and 37 patients with ultrasound intervention treatment, were respectively divided into laparoscopic group and ultrasound intervention group.

2.2. Methods

2.2.1. Operation methods

Laparoscopic surgery methods are as follows. After general anesthesia, a veress needle was introduced at paraumbilical puncture and pneumoperitoneum was established. A small incision was cut both on the left and right lower abdomen. Cannula was put and an observation mirror and surgical instrument were placed in the incision. If the cyst was small, blunt dissection was used to separate cyst and normal ovarian tissues. After that, figure-of-eight suture was carried out and then fibrin glue was sprayed to avoid bleeding and adhesion. If the cyst was large, puncture and aspiration were performed first, and then the inner wall of the cyst was stripped. After that, fibrin glue was sprayed to avoid bleeding and adhesion after figure-of-eight suture was carried out. Ultrasound interventional procedures were as follows. Ultrasound localization was carried out before the operation. After confirming the location of cyst, the puncture point was selected. After local anesthesia and disinfection, cyst was punctured under the guidance of ultrasound. The core needle punctured the 1/3 of cyst midline, then it was pull out and the pipeline was connected. The fluid in the cyst was pumped out with syringe and then the cyst cavity was washed repeatedly with 10–15 mL of anhydrous ethanol. If the fluid in the cyst cavity was coffee-like substance, it was washed with saline for several times first and then with anhydrous ethanol. After washing, liquid was absorbed completely and the needle was pulled out, with gauze bandage covered locally and wrapped.

2.2.2. Evaluation for surgical trauma degree

Before and after operation, 5 mL fasting venous blood of patients in two groups was immediately collected in the morning. After centrifugal separation of serum, the contents of tumor necrosis factor-α (TNF-α), interleukin-1β (IL-1β) and IL-6 were measured by ELISA kit, and the contents of total bilirubin (TBIL), albumin (ALB), creatinine (Cr) and blood urea nitrogen (BUN) were measured by full automatic biochemical analyzer.

2.2.3. Evaluation of postoperative ovarian function

After operation in 3 months, 6 months and 12 months, 5 mL of peripheral venous blood was collected on the days 3–5 of menstrual cycle. After centrifugal separation of serum, the contents of estradiol (E_2), follicle-stimulating hormone (FSH), luteinizing hormone (LH) were measured by radioimmunoassay.

3. Results

3.1. The general situation of patients of two groups

There were no significant differences in patients' ages [(28.96 ± 3.59) *vs.* (29.25 ± 3.51) years], cyst diameters [(9.38 ± 1.15) *vs.* (9.71 ± 1.04) cm], course of disease [(78.56 ± 9.35) *vs.* (80.11 ± 8.96) h] and cyst recurrence (2.70% *vs.* 4.76%) between two groups. The operative time [(32.52 ± 6.39) *vs.* (55.27 ± 7.75) min] and medical costs [(2045.21 ± 343.52) *vs.* (4458.87 ± 625.64) yuan] in ultrasound intervention group were significantly shorter and lower respectively than those in laparoscopic group (Table 1).

3.2. Perioperative blood biochemical indexes

There were no significant changes in perioperative serum of TBIL, ALB, Cr, BUN between patients of two groups and no significant differences in preoperative and postoperative serum of TBIL, ALB, Cr, BUN in ultrasound intervention group ($P > 0.05$). Besides, there were no significant differences in the contents of preoperative serum of TNF-α, IL-1β, and IL-6

Table 1
Comparison on general situation of patients of two groups.

Parameters	Ultrasound intervention group (n = 37)	Laparoscopic group (n = 42)	P
Age (years)	28.96 ± 3.59	29.25 ± 3.51	> 0.05
Cyst diameters (cm)	9.38 ± 1.15	9.71 ± 1.04	> 0.05
Course of disease (h)	78.56 ± 9.35	80.11 ± 8.96	> 0.05
Operative time (min)	32.52 ± 6.39	55.27 ± 7.75	< 0.05
Medical costs (yuan)	2045.21 ± 343.52	4458.87 ± 625.64	< 0.05
Cyst recurrence	1 (2.70%)	2 (4.76%)	> 0.05

($P > 0.05$) in ultrasound intervention group compared with those of laparoscopic group and no significant differences in the contents of postoperative serum of TNF-α, IL-1β, and IL-6 ($P > 0.05$) compared with those of postoperative serum. The contents of serum of TNF-α, IL-1β, and IL-6 of the patients of laparoscopic group after operation were obviously higher than those before operation ($P < 0.05$), while the contents of serum of TNF-α, IL-1β, and IL-6 of the patients of ultrasound interventional group before operation were obviously lower than those of laparoscopic group ($P < 0.05$) (Table 2).

Table 2
Perioperative blood biochemical indexes between the patients of two groups.

Indexes	Time	Ultrasound intervention group (n = 37)	Laparoscopic group (n = 42)	P
TBIL (μmol/L)	Pre-operation	25.23 ± 4.52	24.58 ± 3.59	> 0.05
	Postoperation	24.45 ± 5.61	26.02 ± 5.28	> 0.05
ALB (mg/L)	Pre-operation	38.95 ± 6.82	39.24 ± 5.92	> 0.05
	Postoperation	37.69 ± 5.57	37.08 ± 6.14	> 0.05
Cr (nmol/L)	Pre-operation	67.84 ± 8.89	69.11 ± 9.14	> 0.05
	Postoperation	65.67 ± 7.96	68.76 ± 9.52	> 0.05
BUN (μmol/L)	Pre-operation	6.59 ± 0.85	6.24 ± 0.88	> 0.05
	Postoperation	6.23 ± 0.77	6.36 ± 0.94	> 0.05
TNF-α (pg/mL)	Pre-operation	9.25 ± 1.05	9.45 ± 0.92	> 0.05
	Postoperation	9.86 ± 1.26*	14.68 ± 2.18#	< 0.05
IL-1β (pg/mL)	Pre-operation	40.39 ± 6.25	41.33 ± 6.68	> 0.05
	Postoperation	38.96 ± 5.64*	78.69 ± 9.15#	< 0.05
IL-6 (pg/mL)	Pre-operation	11.58 ± 2.85	11.29 ± 1.58	> 0.05
	Postoperation	12.42 ± 1.94*	28.74 ± 5.92#	< 0.05

*: Differences were statistically significant compared with intra-group before operation, $P < 0.05$; #: Differences were statistically significant compared with laparoscopic group at the same time point, $P < 0.05$.

3.3. Postoperative ovarian function

After operation in 3 months, 6 months and 12 months, there were no significant differences in the contents of serum FSH [(7.69 ± 0.92) *vs.* (7.80 ± 0.82) IU/L], [(7.52 ± 0.91) *vs.* (7.75 ± 0.93) IU/L], [(7.75 ± 0.88) *vs.* (7.67 ± 0.79) IU/L], LH [(5.54 ± 0.77) *vs.* (5.62 ± 0.71) IU/L], [(5.73 ± 0.81) *vs.* (5.73 ± 0.78) IU/L], [(5.66 ± 0.89) *vs.* (5.59 ± 0.93) IU/L], E_2 [(123.51 ± 16.69) *vs.* (125.63 ± 14.45) pg/mL], [(126.73 ± 17.03) *vs.* (124.52 ± 13.68) pg/mL], [(125.64 ± 14.57) *vs.* (126.03 ± 17.49) pg/mL] between the patients of two groups (Table 3).

Table 3
Ovarian function of patients of two groups after the operation.

Parameters	Time after operation	Ultrasound intervention group (n = 37)	Laparoscopic group (n = 42)	P
FSH (IU/L)	3 months	7.69 ± 0.92	7.80 ± 0.82	> 0.05
	6 months	7.52 ± 0.91	7.75 ± 0.93	> 0.05
	12 months	7.75 ± 0.88	7.67 ± 0.79	> 0.05
LH (IU/L)	3 months	5.54 ± 0.77	5.62 ± 0.71	> 0.05
	6 months	5.73 ± 0.81	5.73 ± 0.78	> 0.05
	12 months	5.66 ± 0.89	5.59 ± 0.93	> 0.05
E_2 (pg/mL)	3 months	123.51 ± 16.69	125.63 ± 14.45	> 0.05
	6 months	126.73 ± 17.03	124.52 ± 13.68	> 0.05
	12 months	125.64 ± 14.57	126.03 ± 17.49	> 0.05

4. Discussion

Ovarian cyst pediculotorsion is a common gynecological acute abdomen. Vascular compression caused by ovarian cyst pediculotorsion will lead to tissue necrosis and seriously appear to intratumoral hemorrhage. Once it is diagnosed, surgical treatment should be performed immediately. Traditional laparotomy can cause a major trauma, which has been replaced gradually by minimally invasive treatment such as ultrasound interventional and laparoscopic surgeries[2,9]. In recent years, the effect of ultrasound interventional and laparoscopic surgeries for ovarian cyst pediculotorsion has been more and more recognized[10,11]. Laparoscopic surgery can obtain the operative vision by the endoscope probe and remove cyst so as to avoid the great trauma of laparotomy[12,13]. On the contrary, ultrasound interventional surgery can carry out percutaneous puncture directly under the guidance of ultrasound and immediately complete cyst puncture and ethanol injection and other operations only with the local anesthesia[14]. After analyzing the situation of the two operation methods, the conclusion was drawn that the operation time and the medical cost of ultrasound intervention group is shorter and lower respectively than those of control group. Besides, there was no significantly difference in the recurrence rate after operation between two groups. This result is consistent with the researches of domestic and foreign scholars. That is, the operation is simpler, the operation time is shorter and the curative effect is more accurate. And the long-term recurrence rate of cyst will not be increased.

At present, although the advantages of easy operation and short operation time of interventional ultrasound surgery have been unanimously approved, there are still no clear reports about the degree of trauma of ultrasound interventional and

laparoscopic surgeries for ovarian cyst pediculotorsion. In the process of undergoing surgery of the body, the inflammatory reaction will be significantly activated and TNF-α, IL-1β, IL-6 and other inflammatory cytokines secretion will be increased and released into the blood circulation. TNF-α is the inflammatory factor with the first change in the process of activation of the inflammatory responses which can be amplified by a cascade of inflammatory reaction and promote the release of a variety of inflammatory mediators. IL-1β and IL-6 are cytokines with many biological functions mediating the inflammatory reactions and regulating immune responses[15,16]. The analysis of contents of the serum inflammatory factors above confirmed that the contents of serum of TNF-α, IL-1β and IL-6 did not increase obviously in interventional ultrasound group before and after operation. However, the contents of serum of TNF-α, IL-1β, and IL-6 after operation were significantly higher than those before operation in patients of laparoscopic group. This revealed that the trauma is minimal by interventional ultrasound, which won't result in activation of the inflammatory responses. Although laparoscopic surgery can reduce the trauma, it still inevitably causes the activation of inflammatory responses and is more obvious in overall trauma degree than ultrasound interventional surgery.

Cyst is punctured with interventional ultrasound surgery by guidance of real-time ultrasound, and after aspirating the fluid, the torsional cyst can be also removed. After that, the protein is clotting and degenerating through local injection of absolute alcohol to the cyst cavity, which leads to the adhesion and occlusion of cyst cavity[17]. Anhydrous alcohol has the effect on clotting and degenerating protein, but the poor effect on penetrating tissue. Thus, anhydrous alcohol injecting in the cyst cavity works just in part and does not damage the normal ovarian tissue surrounding the cyst and maximally protects the ovarian function, which is significant for those who have fertility requirements[18,19]. In order to clarify the ovary function of patients after operation, the levels of related hormones in serum were measured and analyzed. The serum contents of FSH, LH, and E_2 are not significantly different between patients of two groups at 3 months, 6 months and 12 months after operation. Therefore, it is proved that ultrasound interventional and laparoscopic surgeries can protect the ovarian function effectively and make the hormone level similar after operation. We believe that although laparoscopic surgery will cause certain injuries and activate inflammatory responses, the use of laparoscopic probe can provide a clear field of vision for the surgical procedure. The accuracy of removal of the cyst can ensure that the cyst is completely removed with no injury of the surrounding normal ovarian tissues as possible. Thus, there is no significant change in long-term sex hormone levels after operation.

To sum up, the curative effect of ultrasound interventional surgery for ovarian cyst pediculotorsion is almost the same with that of laparoscopic surgery, which can reduce surgical trauma and the cost of operation and shorten surgical time.

Conflict of interest statement

The authors report no conflict of interest.

Acknowledgments

This work was financially supported by Science and Technology Planning Project of Hebei Province in 2013 through the project “The Expression and Significance of DJ-1 Protein in Ovarian Canner” (Project No. 132777163).

References

[1] Sadeghian N, Sadeghian I, Mirshemirani A, Khaleghnejad Tabari A, Ghoroubi J, Abdollah Gorji F, et al. Types and frequency of ovarian masses in children over a 10-year period. *Caspian J Intern Med* 2015; **6**(4): 220-3.
[2] Asfour V, Varma R, Menon P. Clinical risk factors for ovarian torsion. *J Obstet Gynaecol* 2015; **35**(7): 721-5.
[3] Kim J, Park D, Han WB, Jeong H, Park Y. Acute abdomen due to ovarian congestion caused by coiling of the fallopian tube accompanied by paratubal cyst around the utero-ovarian ligament. *Obstet Gynecol Sci* 2014; **57**(4): 338-41.
[4] Ashwal E, Krissi H, Hiersch L, Less S, Eitan R, Peled Y. Presentation, diagnosis, and treatment of ovarian torsion in premenarchal girls. *J Pediatr Adolesc Gynecol* 2015; **28**(6): 526-9.
[5] Yildiz A, Erginel B, Akin M, Karadağ CA, Sever N, Tanik C, et al. A retrospective review of the adnexal outcome after detorsion in premenarchal girls. *Afr J Paediatr Surg* 2014; **11**(4): 304-7.
[6] Spinelli C, Pucci V, Strambi S, Piccolo RL, Martin A, Messineo A. Treatment of ovarian lesions in children and adolescents: a retrospective study of 130 cases. *Pediatr Hematol Oncol* 2015; **32**(3): 199-206.
[7] Grabowski A, Korlacki W, Pasierbek M. Laparoscopy in elective and emergency management of ovarian pathology in children and adolescents. *Wideochir Inne Tech Maloinwazyjne* 2014; **9**(2): 164-9.
[8] Sakae C, Sato Y, Taga A, Satake Y, Emoto I, Maruyama S, et al. Ultrasound-guided percutaneous aspiration of hyperreactio luteinalis avoids laparoscopic untwisting of ovarian torsion. *Ultrasound Obstet Gynecol* 2015; **46**(2): 243-6.
[9] Smorgick N, Melcer Y, Sarig-Meth T, Maymon R, Vaknin Z, Pansky M. High risk of recurrent torsion in premenarchal girls with torsion of normal adnexa. *Fertil Steril* 2016; **105**(6): 1561-5.
[10] Minig L, Otaño L, Cruz P, Patrono MG, Botazzi C, Zapardiel I. Laparoscopic surgery for treating adnexal masses during the first trimester of pregnancy. *J Minim Access Surg* 2016; **12**(1): 22-5.
[11] Zolnierczyk P, Cendrowski K, Sawicki W. Transfundal puncture of a large ovarian cyst with hysteroscopic and ultrasonographic guidance. *Int J Womens Health* 2015; **7**: 527-9.
[12] Weiner E, Mizrachi Y, Keidar R, Kerner R, Golan A, Sagiv R. Laparoscopic surgery performed in advanced pregnancy compared to early pregnancy. *Arch Gynecol Obstet* 2015; **292**(5): 1063-8.
[13] Fujishita A, Araki H, Yoshida S, Hamaguchi D, Nakayama D, Tsuda N, et al. Outcome of conservative laparoscopic surgery for adnexal torsion through one-stage or two-stage operation. *J Obstet Gynaecol Res* 2015; **41**(3): 411-7.
[14] Pal S, Chakrabarti S, Deuoghuria D, Phukan JP, Sinha A, Mondal PK. Evaluation of ultrasound-guided fine-needle aspiration cytology of ovarian masses with histopathological correlation. *Acta Cytol* 2015; **59**(2): 149-55.
[15] Trehan A, Trehan AK. Laparoscopic management of a dermoid cyst containing a tooth-bearing mandible-like structure and possible chronic adnexal torsion. *J Obstet Gynaecol* 2014; **34**(7): 656-7.
[16] Dubuisson J, Fehlmann A, Petignat P. Management of presumed benign giant ovarian cysts: a minimally invasive technique using the Alexis Laparoscopic System. *J Minim Invasive Gynecol* 2015; **22**(4): 540.
[17] Castellarnau Visus M, Ponce Sebastia J, Carreras Collado R, Cayuela Font E, Garcia Tejedor A. Preliminary results: ethanol sclerotherapy after ultrasound-guided fine needle aspiration without anesthesia in the management of simple ovarian cysts. *J Minim Invasive Gynecol* 2015; **22**(3): 475-82.
[18] García-Tejedor A, Castellarnau M, Burdio F, Fernández E, Martí D, Pla MJ, et al. Ultrasound-guided aspiration of adnexal cysts with a low risk of malignancy: is it a recommendable option? *J Ultrasound Med* 2015; **34**(6): 985-91.
[19] Wu X, Xu Y. Gestrinone combined with ultrasound-guided aspiration and ethanol injection for treatment of chocolate cyst of ovary. *J Obstet Gynaecol Res* 2015; **41**(5): 712-6.